

WebPanel 1. Methods for estimating gray wolf pack size when direct counting methods were not available

Some parks and preserves (hereafter, “parks”) included in our analysis conducted gray wolf (*Canis lupus*) counts at different times of the year as compared to other parks. To obtain the most accurate and comparable counts for pack size between parks, we estimated pack size for some parks for some times of the year. Pack sizes were reported for spring prior to denning season (an annual low) in four of the five parks, fall (generally close to the annual high) for four of the five parks, and mid-winter for three of the five parks. Spring pack sizes were directly counted in Denali National Park and Preserve (DNPP), Voyageurs National Park (VNP), Yellowstone National Park (YNP), and Yukon-Charley Rivers National Preserve (YCRNP). Fall pack sizes were directly counted in DNPP, VNP, YNP, and YCRNP. Mid-winter pack sizes were directly counted in Grand Teton National Park (GTNP), VNP, and YNP. We used two different methods to account for the four missing counts (GTNP in spring, GTNP in fall, DNPP in mid-winter, and YCRNP in midwinter).

To estimate GTNP pack sizes in spring, we used a correction factor obtained from the percent change in pack size for packs using YNP from the mid-winter count to the spring count (0.866). The decrease in pack size ($\text{GTNP mid-winter pack size} \times 0.866 = \text{GTNP spring pack size}$) from mid-winter to spring was estimated to be approximately the same because the wolves live in the same ecosystem and survival rates likely do not greatly differ during these 3 months. We calculated this for each pack year. To estimate GTNP pack sizes in fall, we also used a correction factor from YNP for the likely pack size prior to the mid-winter count, in the fall (1.39). This correction factor ($\text{GTNP mid-winter pack size} \times 1.39 = \text{GTNP fall pack size}$) was applied to each pack year.

To calculate mid-winter counts for DNPP and YCRNP, we averaged the fall pack count and the following spring pack count for each pack year. The mid-winter count is approximately 3 months after the fall count and 3 months prior to the spring count. Within this 6-month period, because wolf survival during the first 3 months was not substantially different from wolf survival during the second 3 months, we believe that our methodology provides an appropriate estimate for pack size in these areas.